III. " On the Commissures of the Cerebral Hemispheres of the Marsupialia and Monotremata, as compared with those of the Placental Mammals." By W. H. Flower, F.R.S.   Received January 24, 1865.

(Abstract.)

As it is most convenient to pass from the best to the least known, and especially as the terms used in describing the anatomy of the vertebrated animals have in most cases been originally bestowed upon parts of the human body, the Paper commences by a short description of the septum ventriculorum and commissures of the human brain.   This is done with a view to establish clearly, both by their structure and development, the mutual relations of the great transverse commissure or corpus callosum and the fornix.   The latter is defined as essentially a longitudinal commissure, consisting of two lateral halves closely applied for a short space in the middle line, but each half belonging to its own hemisphere, and formed out of the longitudinal fibres bordering the superior margin of the ventricular aperture.   There are no transverse fibres in the fornix proper, the so-called " psalterial fibres " connecting together the two hippocampi majores being a portion of the same system of fibres as the corpus callosum.

The relations of these parts are shown in a series of longitudinal and vertical sections of the brains of the Sheep, Rabbit, Two-toed Sloth, and Hedgehog among Placental Mammals, and in the same way in the Kangaroo, Wombat, and Thylacine among Marsupials, and the Echidna among Monotremes.

After reference to the literature of the subject, more especially to the writings of Professor Owen, whose statement (Phil. Trans. 1837) of the absence in the marsupials of the "corpus callosum," or "great transverse commissure which unites the supra-ventricular masses of the hemispheres," in all placentally developed mammals * has been almost universally adopted, the author proceeds to sum up the result of the present investigation as follows.

At the outset a confirmation is afforded of the important fact, first observed by Professor Owen, that the brains of animals of the orders Marsupialia and Monotremata present certain special and peculiar characters, by which they may be at once distinguished from those of other mammals.   The appearance of either a transverse or longitudinal section would leave no doubt whatever as to which group the brain belonged.   In

---

* In the paper by the same author " On the Characters, Principles of Division, and Primary Groups of the Class Mammalia " (Proc. Linn. Soc. 1858), the Subclass *Lyencephala* ("loose" or "disconnected" brain), equivalent to the Marsupialia and Monotremata, are characterized as having "the cerebral hemispheres but feebly and partially connected together by the 'fornix' and 'anterior commissure,' while in the rest of the class a part called 'corpus callosum' is added, which completes the connecting or commissural apparatus."

the differentiating characters to be enumerated, some members of the higher section present an approximation to the lower; but, as far as is known at present, there is still a wide interval between them without any connecting link.

The differences are manifold, but all have a certain relation to, and even a partial dependence on, each other. They may be enumerated under the following heads :—

1. The peculiar arrangement of the folding of the inner wall of the cerebral hemisphere. A deep fissure, with corresponding projection within, is continued forwards from the hippocampal fissure, almost the whole length of the inner wall.

2. The altered relation (consequent upon this disposition of the inner wall) and the very small development of the upper transverse commissural fibres (corpus callosum).

3. The immense increase in amount, and probably in function, of the inferior set of transverse commissural fibres (anterior commissure).

Each of these propositions must now be considered a little more closely. Arguing from our knowledge of the development of the brain in placental mammals (for of that of the marsupials we have at present no information), it may be supposed that the first-named is also first in order of time in the gradual evolution of the cerebral structures. Before any trace of the budding out of the fibres which shoot across the chasm separating the hollow sac-like hemispheres, before the differentiation of a portion of the septal area into the anterior commissure, that remarkable folding of the inner wall, indicated by the deep (hippocampal) furrow on the surface and the corresponding rounded projection in the interior, has already become distinctly manifest.

Now the first rudiment of the upper transverse commissure is found undoubtedly at the spot, afterwards situated near its middle, to which in the lowest placental mammals it is almost entirely confined. This spot is situated a little way above and in front of the anterior end of the ventricular aperture, at the upper edge of the region of adherence of the two hemispheres (the future septal area). In the placental mammals this part is in direct relation to the great mass of the internal medullary substance of the hemispheres, which has to be brought into communication. In the marsupials, on the other hand, the prolonged internal convolution or hippocampus spreading up to and beyond this point, forms the inner wall of the hemisphere from which the fibres pass across, and it is necessarily through the medium of this convolution, and following the circuitous course of its relief in the ventricle, that the upper part of the hemisphere can alone be brought into connexion with its fellow.

Can this transverse commissure, of which the relation is so disturbed by the disposition of the inner wall of the hemisphere, be regarded as homologous to the entire "corpus callosum" of the placental mammals? or is it, as has been suggested, to be looked upon as only representing the

psalterial fibres or transverse commissure of the hippocampi? Undoubtedly a large proportion of its fibres do come under the latter category. But even if they should nominally be all so included, it is important to bear in mind that we have still a disposition in the marsupial brain very different from that which would remain in the brain of any placental mammal after the upper and main part of the corpus callosum had been cut away. In the latter case the commissure of a very small part of the inner wall of the hemisphere alone is left, that part folded into the hippocampus. In the former there is a commissure, feeble it may be, but *radiating over the whole of the inner wall, from its most anterior to its posterior limits.* Granted that only the psalterial fibres are represented in the upper commissure of the marsupial brain, why should the name of " corpus callosum " be refused to it? These fibres are part of the great system of transverse fibres bringing the two hemispheres into connexion with each other; they are inseparably mingled at the points of contact with the fibres of the main body of the corpus callosum, and are only distinguished from it in consequence of the peculiar form of the special portions of the hemisphere they unite. Indeed they are scarcely more distinct than is the part called " rostrum " in front. And although, like the fibres of the hinder end of the corpus callosum, they blend at each extremity with the fibres of the diverging posterior crura of the fornix, they certainly cannot be confounded with that body, which, as shown before, is essentially a longitudinal commissure.

But is not the main part of the " corpus callosum " of the placental mammals also represented by the upper and anterior part of the transverse band which passes between the hemispheres of the marsupial brain and radiates out in a delicate lamina above the anterior part of the lateral ventricle? The most important and indeed crucial test in determining this question, is its position in regard to the septum ventriculorum, and especially the precommissural fibres of the fornix. Without any doubt in all marsupial and monotreme animals examined (sufficient to enable us to affirm without much hesitation that the character is universal) it lies *above* them, as distinctly seen in the transverse sections. This is precisely the same relationship which obtains in Man and all other mammalia, and this is one of the chief points in which not only the interpretation of facts but the observation of them recorded in the present paper differs from that of Professor Owen.

The defective proportions of the part representing the great transverse commissure of the placental mammals, which appear to result from or to be related to the peculiar conformation of the wall of the hemisphere, must not lead to the inference that the great medullary masses of the two halves of the cerebrum are by any means " disconnected." The want of the upper fibres is compensated for in a remarkable manner by the immense size of the anterior commissure, the fibres of which are seen radiating into all parts of the interior of the hemisphere. There can be little doubt that the development of this commissure is, in a certain measure, comple-

mentary to that of the corpus callosum. This is, moreover, a special characteristic of the lowest group of the mammalia, most remarkable because it is entirely lost in the next step of descent in the vertebrated classes.

After a description of the brain of a bird, the conclusion is arrived at that, great as is the difference between the placental and implacental mammal in the nature and extent of the connexion between the two lateral hemispheres of the cerebrum, it is not to be compared with that which obtains between the latter and the oviparous vertebrate.

IV. " Note on the Atomicity of Aluminium." By Professor A. W. WILLIAMSON, F.R.S., President of the Chemical Society. Received February 6, 1865.

In the " Preliminary Note on some Aluminium Compounds," by Messrs. Buckton and Odling, published in the last Number of the Society's ' Proceedings,' some questions of considerable theoretical importance are raised in connexion with the anomalous vapour-densities of aluminium ethyle and aluminium methyle. The authors have discovered that the vapour of aluminium methide ($Al^2 Me^6$) occupies rather more than two volumes ($H = 1$ vol.) at 163°, when examined by Gay-Lussac's process, under less than atmospheric pressure. The boiling-point of the compound under atmospheric pressure is given at 130°, and the compound accordingly boiled a good deal below 130° at the reduced pressure at which the determination was made. The vapour was therefore considerably superheated when found to occupy a little more than two volumes. When still further superheated up to 220° to 240°, it was found to possess a density equivalent to rather less than four volumes at the normal temperature and pressure.

The aluminium ethyle was found to have a density decidedly in excess of the formula $Al^2 Et^6 = 4$ vols., but far too small for $Al^3 Me^6 = 2$ vols. From their analogy to aluminic chloride, $Al^2 Cl^6 = 2$ vols., the methide and ethide might be expected to have vapour-volumes corresponding to $Al^2 Me^6 = 2$ vols., $Al^2 Et^6 = 2$ vols. The authors seem, however, more inclined to doubt the truth of the general principles which lead us to consider these hexatomic formulæ the correct ones, than to doubt their own interpretation of the observations already made upon the new compounds.

Even if the vapour-volume of aluminic chloride had been unknown to us, there were ample grounds for assigning to aluminium methide a molecular formula $Al^2 Me^6$, and a vapour-density corresponding to $Al^2 Me^6 = 2$ vols.; for the close analogy of aluminic and ferric salts is perfectly notorious, and the constitution $Fe^2 O^3$ for ferric oxide settles $Al^2 O^3$ as the formula for alumina. With regard, however, to the chlorides of these metals, it might be supposed that the formula $Fe Cl^3$ and $Al Cl^3$ would be the most probable molecular formulæ ; and Dr. Odling, in his useful Tables of Formulæ, published in 1864, expressed an opinion in favour of these formulæ by classing